

# Development of Sustainable Cities Using Pak-SBAS

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Apr 2024



United Nations/Philippines Workshop on the Applications of Global Navigation Satellite Systems





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# Introduction



- Pakistan through its National Space Agency, Space and Upper Atmosphere Research Commission - SUPARCO ([www.suparco.gov.pk](http://www.suparco.gov.pk)) is developing Pakistan Space Based Augmentation System (Pak-SBAS)
- The System will use Multi-GNSS (GPS, BeiDou) signals for improving the accuracy and reliability of existing Positioning, Navigation, and Timing (PNT) service in Pakistan
- The System is scheduled to be commissioned by the mid of year 2024
- The System is envisaged to significantly promote adoption of precise positioning GNSS services in the socio-economic sectors of Pakistan



# Introduction



- Pak-SBAS will offer two type of services:
  - Public service will provide integrity based enhanced sub-meter level accuracy to meet Safety-of-Life (SoL) positioning requirements of the transportation sector (aviation, marine, land, rail)
  - Authorized service will provide decimeter level accuracy based on Precise Point Positioning (PPP) technology to meet positioning requirements of Non Safety-of-Life (Non-SoL) applications such as surveying & mapping, urban planning & infrastructure development, disaster management, etc



# Overview



- Public Service:
  - The Pak-SBAS will comply with the SBAS requirements of ICAO published in Annex 10 - Aeronautical Communications, Volume I, Radio Navigation Aids
  - The Pak-SBAS L1 SIS (Signal-In-Space) will comply with the corresponding requirements in the SBAS Minimum Operational Performance Standards (MOPS, DO-229E) published by RTCA (Radio Technical Commission for Aeronautics)
  - The Pak-SBAS L5 SIS will comply with the corresponding requirements published by RTCA DO-401 / EUROCAE ED-259A



# Overview



- Authorized Service:
  - The Pak-SBAS will comply with corresponding requirements in the BeiDou Navigation Satellite System SIS Interface Control Document Precise Point Positioning Service Signal PPP-B2b (version 1.0) published by China Satellite Navigation Office (CSNO)
  - Pak-SBAS Authorized Service will be offered in following phases:
    - Phase-I (Initial Operational Capability) will provide precise positioning service with convergence time of 30 min
    - Phase-II (Full Operational Capability) will improve the positioning service by reducing its convergence time for users in Pakistan & surrounding areas



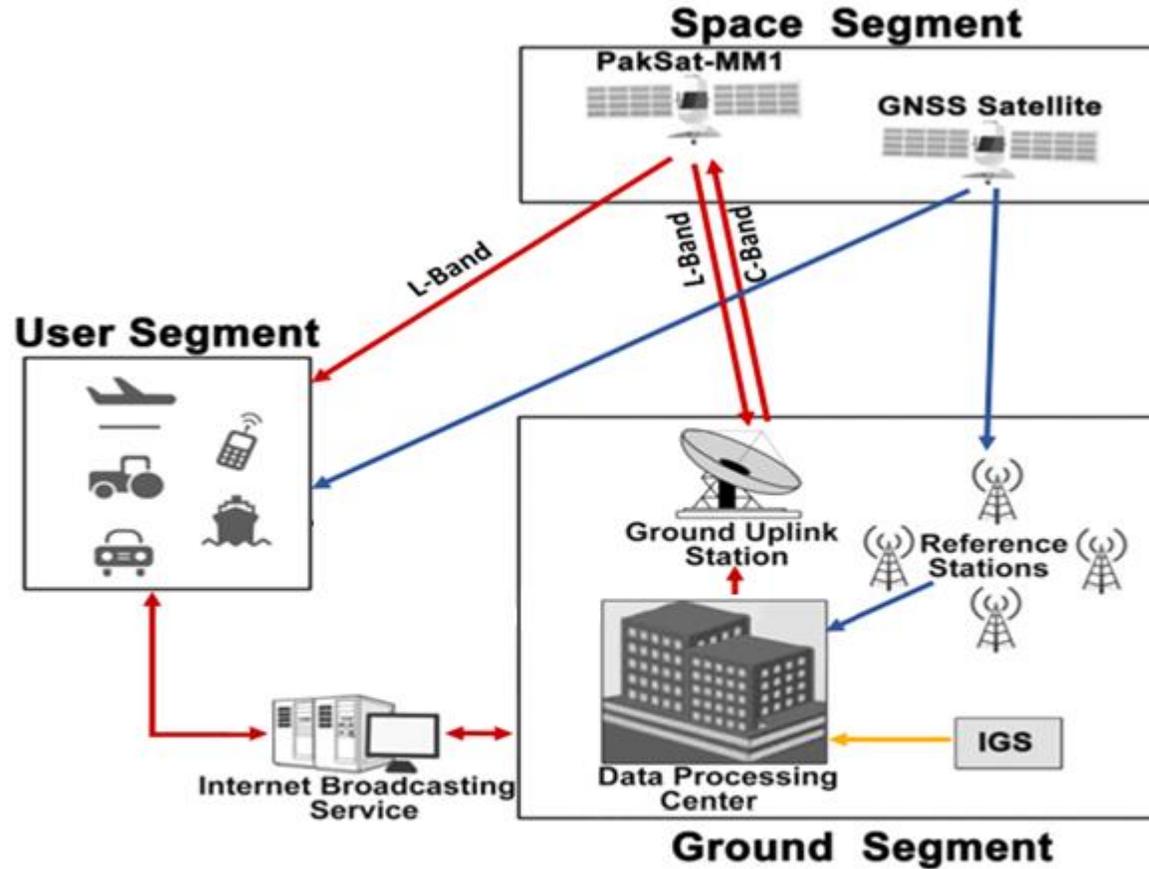
# Architecture

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- Space Segment
  - SBAS Payload onboard PakSat MM-1 satellite (GEO-1) at  $38.2^{\circ}$
- Ground Segment
  - 01 x Data Processing Center (DPC)
  - 12 x Range and Integrity Monitoring Stations (RIMS)
  - 01 x Ground Uplink Station (GULS)
  - Data Communication Network
  - Interface with International GNSS Service (IGS)
- User Segment
  - Pak-SBAS receivers for SoL and Non-SoL applications



# Configuration



- Navigation Message
- Augmentation Message
- IGS Data & Products



# Applications



**Aviation**



**Marine**



**Road/Highway**



**Railway**



**Agriculture**



**Surveying & Mapping**



**Urban Planning**



**Disaster Management**

# Applications for Sustainable Cities



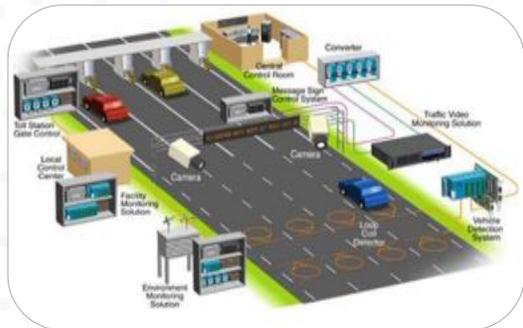
**Urban Planning**



**Smart Urban Mobility**



**Surveying & Mapping**



**Transportation**



**Governance**



**Waste Management**

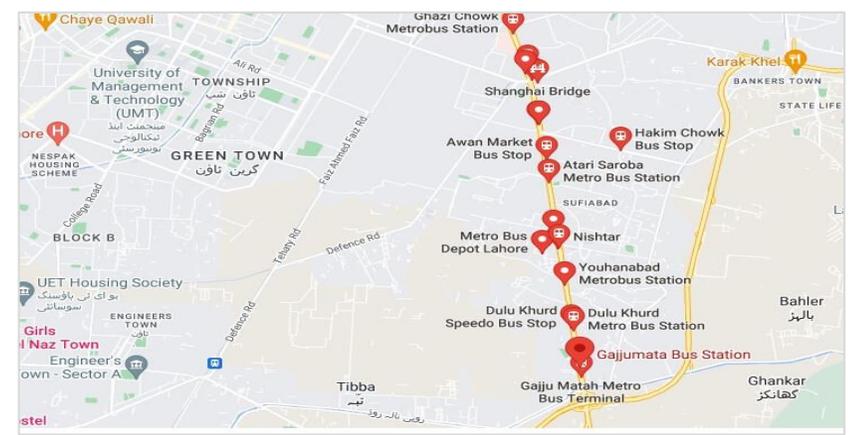
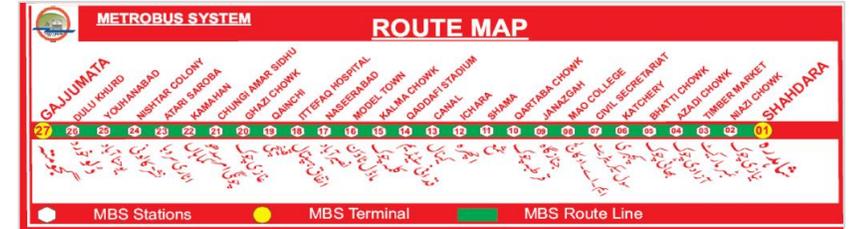




# Smart Urban Mobility



- Pakistan is utilizing smart traffic control solutions for Metro Bus Service
- The aim is to provide safe, efficient and comfortable urban transportation system
- Integration of Pak-SBAS services will assist in making more informed decisions for route optimization & vehicle tracking





# Surveying & Mapping

- Various large scale development projects have been initiated by Govt. of Pakistan
- These projects require accurate spatial data for infrastructure development
- Availability of Pak-SBAS services will enhance the reliability & efficiency of operations thru provision of high-precision ubiquitous geospatial data



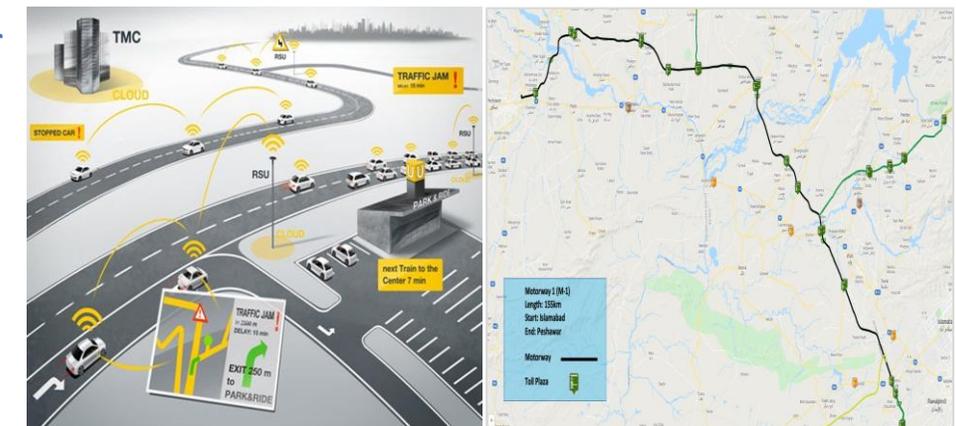


# Transportation



Pak-SBAS

- Govt. of Pakistan has undertaken development of Intelligent Transportation System (ITS) that offers
  - Traveler information
  - Emergency response
  - Toll collection
- Pak-SBAS integrity based services for ITS will offer unique advantages of
  - Vehicle tracking
  - Monitoring traffic flow
  - Rapid incident response



# Governance (Safe City project)



- Provincial Police has initiated Integrated Command, Control & Communication Center program
- It utilizes GNSS coupled with latest technology to improve operational efficiency
- Pak-SBAS services will assist in improving the precise accuracy of resource location and emergency response management

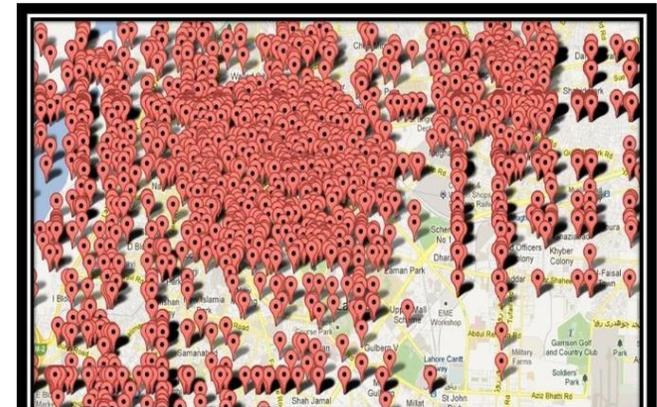




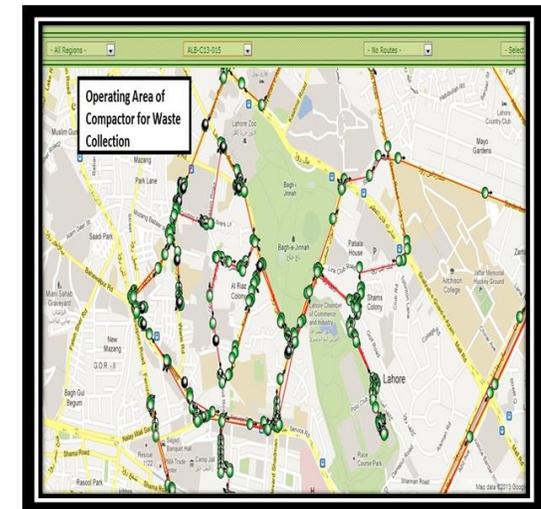
# Waste Management



- GNSS based systems for waste management have been utilized by the provincial governments for
  - Locating garbage
  - Guiding collection vehicles
  - Sending images to Central Control Station
- Integration of Pak-SBAS services will assist in optimizing waste management with precise vehicle positioning and disposal monitoring



Android App based monitoring



Vehicle Tracking System

# Conclusion

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- Pakistan is diligently working on implementation of Pak-SBAS
- Integration of Pak-SBAS services will bring fruitful outcomes for socio-economic development specifically for sustainable cities in Pakistan
- Pakistan is seeking cooperation of GNSS Community and Industry to adopt advanced GNSS technology services and applications in Pakistan



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# Thank You

